C. Segment B - New Technologies Supporting Linkages
(2) Session B1- Linking Through a Common Understanding of the Battlespace
a. Introduction Summary
[intro_might]

Linking Simulations - Starting with a Conceptual Model of the Mission Space (CMMS)

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Background

Military operations are complex processes with intricate linkages among the processes. Developing a simulation of military operations starts with a clear and comprehensive understanding of these complex processes and their linkages. This understanding is especially critical when trying to link two or more simulations that represent different parts of a military operation.

This clear and comprehensive understanding is difficult to obtain because there are so many sources of information and no way to determine which source is appropriate or best. This is compounded by the fact that many sources describe the operations using different terms for the same process or entity - making the linkages almost impossible to identify.

A Conceptual Model of the Mission Space (CMMS) alleviates many of these problems by developing a common, clear and comprehensive view of real world operations. This common understanding is the logical place to start linking simulations of processes that are linked in the real world.

Figure 1 places the CMMS in perspective with the real world and the software developer's world. A CMMS is the first abstraction or representation of the real world; it is the first model of the complex processes that are to be simulated. Linking different simulations is easier when all models that are used in the simulations being linked are derived from a common CMMS.

These derivative models are developed by operations researchers and will vary substantially in level of detail. The closer a simulation is to an "emulation" of real world operations, the more detailed a CMMS must be - it must have almost real world detail to provide a software engineer the information needed to design and build the simulation. If a simulation does not need to be, or for some reason can not be, a high fidelity- almost real world - representation, then the operations research community must develop

models that aggregate the processes and entities.

When models within two or more simulations that are going to be linked have little or no documentation it becomes a difficult or impossible task to develop a clear understanding of the processes that are being represented. Add to this the fact that the real world experts who described these processes during the original model development are no longer available to answer questions - if they can even be identified - and there is no cost effective way to identify how simulations should be linked from a real world perspective.

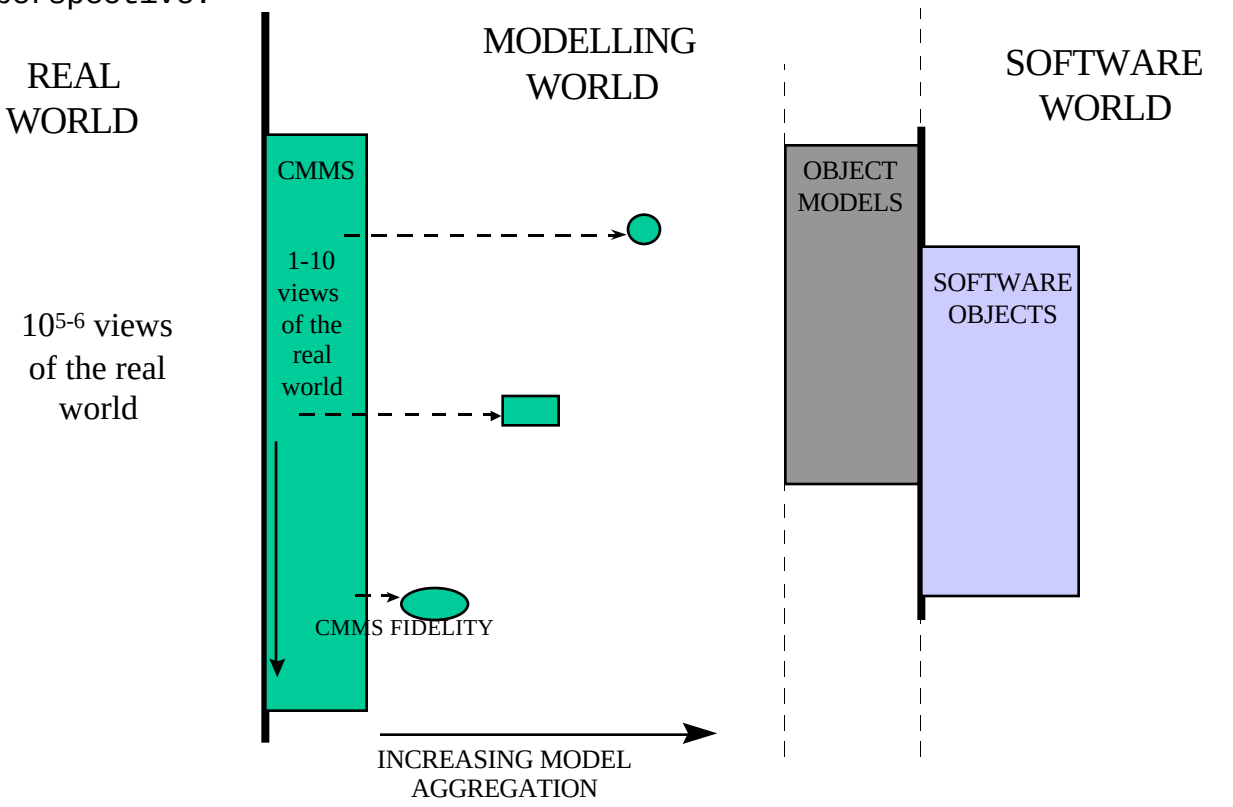

Figure 1 - Placing CMMS in Perspective

In these cases it almost always seems easier and more cost effective to use one simulation as the base and build new "modules" rather than link to existing simulations. The reengineering costs are too high - in terms of both money and time. Linking models in simulation by using a common CMMS as the framework for deriving these models significantly reduces these costs.

Using this common starting point for the models that are part of our simulations makes the models highly coupled. This coupling occurs naturally, it is a derivative of the common syntax (structure) and semantics in the CMMS that are inherited by each model. The common structure makes it easy to identify where processes in the real world are linked. The common semantics makes it easy for simulation developers to communicate about the real

world processes and models efficiently.

This coupling along with the significant savings in reengineering makes a CMMS the natural starting point for linking or integrating simulations. Regardless of how the simulations are linked - through data or at run time - the entire process is more efficient and effective when the models in a simulation have been derived from a common CMMS.

Presentations

The papers presented in this session provided a clear picture of how a CMMS can be used to help link simulations. Since there are no CMMSs currently in a repository the efforts described how the JCOS and JWARS projects approached the CMMS as innovators. They described how they developed a CMMS and how they used it. Most important, however, was there descriptions of the advantages of using a CMMS and what they would do differently in the future.

The presentation by Guy Carrier from MITRE described how they used two different processes for developing a CMMS and what the impact was when they tried to link the results and then use them in their run time linkage. Their problems were compounded by the fact that the simulations had embedded models that were not always well documented and there was a considerable reengineering effort. The audience should recognize how much more could have been accomplished if there had been a CMMS before they started and how much easier it would have been to identify how the models should be linked.

The presentation by LTC Terry Prosser from the JWARS Program Office described how they have developed a process for developing a CMMS and where that fits into the JWARS development. They recognized the value of having a standard process and tool set for performing the Knowledge Acquisition (KA) and documenting the results. Since their effort is truly plowing new ground they have identified advantages that have already been realized and changes in the CMMS development that could potentially provide significant additional value.

Summary

Linking simulations is easiest if the underlying linkages among the models in the simulations are easily identified. Past simulation developments did not document the representations that were used to arrive at the models that were eventually embedded in their simulations. This lack of traceability back to the real world or the first abstraction of the real world has made linkage of two or more simulations difficult.

A CMMS provides the common view of the real world that makes these linkages both effective and efficient to implement. This reduces reengineering costs which makes linkage among simulations more attractive. The common syntax and semantics in a CMMS ensures

that all the derivative models are highly coupled. The cost savings and natural coupling make the CMMS the logical place to start linking simulations.